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PLANTAE COLOMBIANAE II

BY

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YOCO: A STIMULANT OF SOUTHERN COLOMBIA

THE NUMBER OF SPECIES used as narcotics and stimulants by the Indians of Middle and South America is comparatively small. Nevertheless, the botanical source of several, until recently, has remained doubtful or unknown. During the last twenty-five years, extensive research in the identification of narcotics and stimulants has been carried out. As a result, at the present time, nearly all of the species which are used have been identified.

One of the few important exceptions is the remarkable *yoco* which has long been employed as a stimulant by the Indians of a small part of southern Colombia and the adjacent regions of Ecuador and Peru.

During the course of ethnobotanical studies in the Putumayo, Colombia,¹ in 1941 and 1942, I found that the most important non-alimentary plant in the economy of the natives of the tropical areas is *yoco*. The flowering of the *yoco* plant—an extensively climbing liana—is apparently sporadic and capricious, and it was possible to collect fertile material only after months of search. Infrequency of flowering is probably one of the reasons for the neglect by botanists of this important economic plant.

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While there is a possibility that yoco comprises several species, the only one known to be used in the Putumayo among the Inga, Siona and Kofán Indians represents an undescribed species of the sapindaceous genus *Paullinia* which is herewith described. It has been thought appropriate to employ as a specific epithet the common name by which the plant is known in the area where its use as a stimulant is practiced.

I. Description of yoco

Paullinia Yoco *Schultes & Killip sp. nov.*

Frutex scandens, extensus, robustusque. Rami robusti, basi usque ad 12 cm. in diametro, lactiferi, lacte albo astringentique, nigro cum cortice lenticellato scabroque. Ramuli subteretes, obtuse angulati et fibroso-striati, ferruginei, scabridiusculi, minute pulverulento-puberuli denique subglabrescentes, internodiis brevibus, pampinis robustis frequentibusque, circinalibus, denique valde crasso-ligneis. Folia plerumque quinque-pinnata, usque ad 35 cm. (rarissime usque ad 45 cm.) longa, fere aequaliter lata. Rhachides nudae, (exalatae), firmae, leviter fibroso-striatae, ferrugineae, parce puberulae, 6–20 cm. longae, 2–3 mm. in diametro, quattuor-sulcatae. Foliola majora, elliptica, 15–25 (plerumque plus minusve 20) cm. longa, 8–11 cm. lata, superiora plus minusve obovata, apice breviter acuminata acumine obtuso, margine integerrima, coriaceo-chartacea, utrinque glabra, subsessilia (petiolis nudis, usque ad 5 mm. longis, plus minusve 2 mm. in diametro), viva utrinque atroviridia, subtus nitida (in sicco flavo-fulva), clathrato-venosa, lateralibus cum nervis septem ad novem supra impressis subtus prominenter et valde elevatis, nervo praecipuo utrinque minutissime scabridiusculo-puberulo. Thyrsi solitarii, sparsissime et minute pulverulento-puberuli, robusta cum rhachide 7–25 (plerumque 10–15) cm. longa et 3 mm. in diametro,

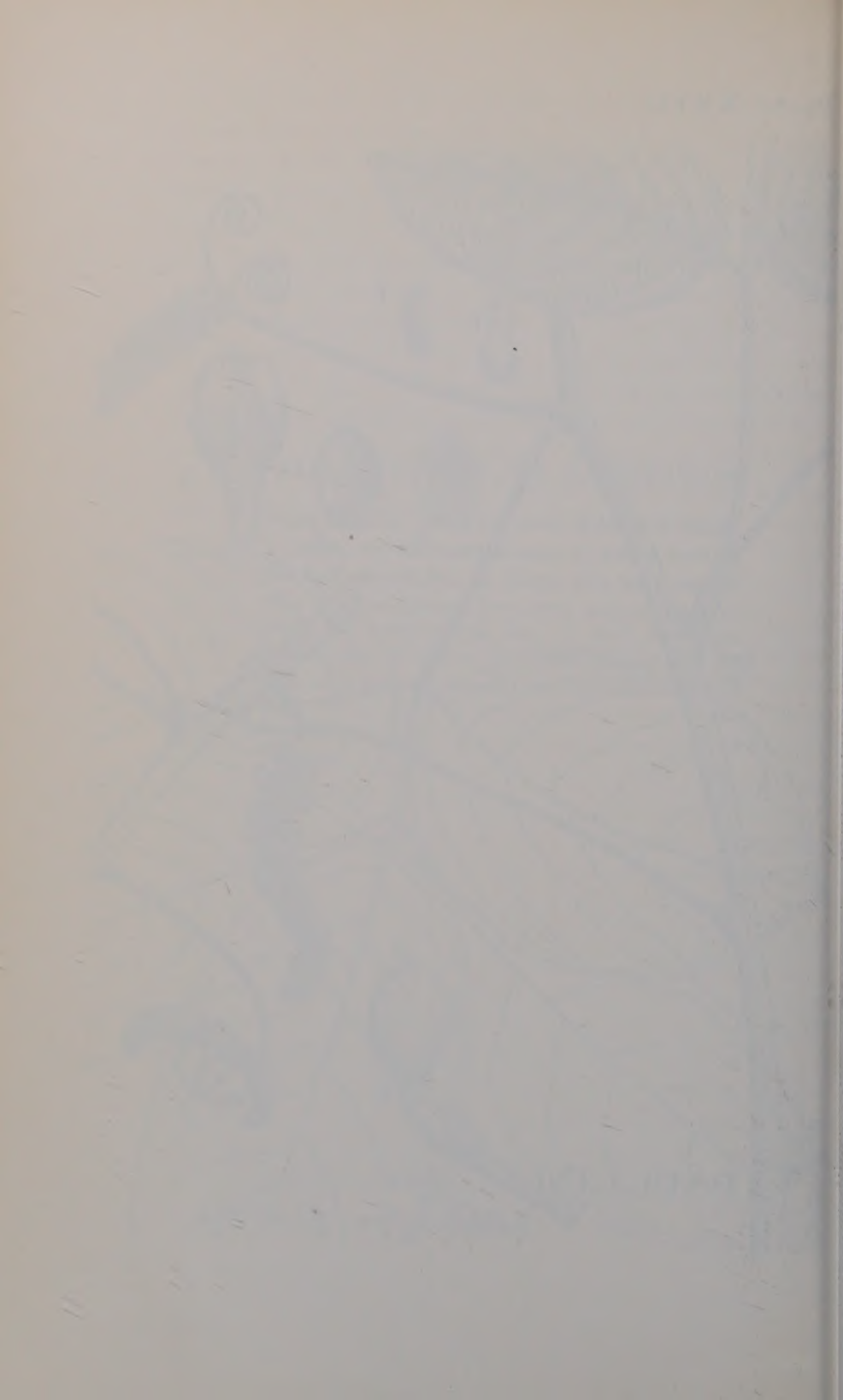
saepe basi contracta. Inflorescentia axillaris, racemiformis, rarerer bifurcata, multi- (usque ad 250-) flora, aliquid cincinnalis, 4-10 (plerumque plus minusve 8) cm. longa. Pedicelli comparate robusti, 3-8 (plerumque 5-6) mm. longi, minute sed densius hirtello-pilosi, gracilibus cum bracteis minutissimis acuminatissime linguiformibus vel triangulari-subulatis, dense hirtello-pilosulis. Flores parvi sed satis robusti, albo-flavidi, aliquid mucosi. Sepala quinque; sepala duo exteriora subcoriacea, extus tomentulosa, intus glabra, subovalia, apice rotundata, plus minusve 1.8 mm. longa et 1.2 mm. lata, margine pseudofimbrillifera vel villosa-ciliata; sepala interiora tria majora, satis membranacea, rotundata, intus glabra, plus minusve 2.8 mm. longa, fere aequaliter lata, valde inflexis cum marginibus sparse villosiusculis. Tori glandulae minutae linguiformes, dense pilosae. Petala quattuor, submembranacea, integra, obovata, intus minute pilosiuscula, 2.3 mm. longa, 2 mm. lata, margine non villosiuscula. Stamina octo, circa pistillum inserta, ex floribus haud exserta. Stamina filamenta complanata, pilis albis longioribus lanatisque extus vestita, 1 mm. longa. Antherae glabrae, 0.7 mm. longae. Ovarium globosum, glabrum, plus minusve 1 mm. in diametro, crasso cum stylo glabro in circuitu triangulari, 0.6 mm. lato, 1 mm. longo; stigma profunde (usque ad 0.3 mm.) trifidum lobis crassis. Fructus capsularis, trivalvis, subdrupaceus, in maturitate rubens, gustatu astringens amarusque; capsula oblique ovoidea, in stipitem attenuata, rostrata (styli reliquiis coronata), ecos-tata et exalata, epicarpio parum crasso, praeter stipitis basim glabra (capsula sicca valde crustacea, superficie laevigata enervia ecostataque), 10-14 mm. longa, 4-7 mm. lata, rostro usque ad 2 mm. longo. Semina globosa, quasi omnino arillata.

Extensive, woody liana. Stems stout, up to 12 cm. in diameter at the base, with a milky-white astringent

EXPLANATION OF THE ILLUSTRATION

PLATE XXVII. *PAULLINIA YOCO* *Schultes & Killip*.
1, plant, one half natural size. 2, woody tendril,
one half natural size. 3, flower, five times natural
size. 4, sepal (large), five times natural size. 5,
petal, five times natural size. 6, pistil, five times
natural size. 7, stamen, five times natural size. 8,
fruit with pedicel, two and one-half times natural
size.





sap. Branchlets subterete, obtusely angled, striate, ferruginous, minutely pulverulent-puberulent becoming almost glabrous, with circinate tendrils which become woody. Leaves usually 5-foliolate. Axes exalate, 4-sulcate, strong, ferruginous, slightly puberulent. Leaflets elliptic (the upper obovate, obtusely acuminate, the lower rotundate), 15–25 cm. long, 8–11 cm. wide, entire, coriaceous-chartaceous, glabrous on both sides, clathrate-nerved with seven to nine nerves. Inflorescence axillary, racemiform, many-flowered, circinate. Pedicels minutely hirtellous, with very small bracts which are acuminate linguiform or triangular-subulate. Sepals five; the outer two subcoriaceous, externally tomentulose, internally glabrous, almost oval, apically rounded with a villose-ciliate margin; the inner three larger, membranaceous, rounded, internally glabrous. Petals four, submembranaceous, entire, obovate, internally minutely pilose. Stamens eight, not exerted, with strong complanate filaments which are covered with white woolly hairs. Ovary globose and glabrous with a fleshy style and a trifold stigma. Fruit subdrupaceous, red when ripe, obliquely ovoid, rostrate.

SPECIMENS EXAMINED:

COLOMBIA: Comisaría del Putumayo, Río Putumayo, Puerto Ospina, 15 kilometros adentro en la trocha Puerto Ospina—Puerto Asís; alt. ca. 300 m., 6 julio, 1942, *Richard Evans Schultes 4028* (TYPE in Econ. Herb. Oakes Ames Nos. 10432 and 10433, sheets I and II; DUPLICATE TYPES in Herb. Nac. Colomb.; U.S. Nat. Herb.; Herb. Gray).

Comisaría del Putumayo, Umbria, $0^{\circ} 54' N.$, $76^{\circ} 10' W.$, alt. 325 m., forest, January-February 1931, *G. Klug 1933*, "blanco yoco" (U.S. Nat. Herb. No. 1518079); same locality and date *G. Klug 1935*, "huarmy yoco," (U.S. Nat. Herb. No. 1518082).

The following sterile specimens have been examined and found to be referable to *Paullinia Yoco*:

Comisaría del Putumayo, Río Putumayo, Piñuna Negra, alt. 240 m., diciembre, 1940, *J. Cuatrecasas 10708* (Herb. Nac. Colomb.; U.S. Nat. Herb.).

Comisaría del Putumayo, alta cuenca del Río Uchupayaco, al suroeste de Puerto Limón, alt. 300 m., 27–28 febrero, 1942, *Richard Evans Schultes* 3341; Río Putumayo, Puerto Ospina y los alrededores, alt. ca. 250 m., 23–25 marzo, 1942, *Richard Evans Schultes* 3426; Río San Miguel ó Sucumbíos, Conejo y los alrededores, en frente de la Quebrada Conejo, alt. ca. 300 m., 2–5 abril, 1942, *Richard Evans Schultes* 3543, “yoco colorado” (all in Herb. Nac. Colomb. and in Econ. Herb. Oakes Ames).

Comisaría del Putumayo, Mocoa y los alrededores al norte, alt. 750–850 m., 3–7 diciembre, 1941, *Richard Evans Schultes & C. Earle Smith* 3045 (Econ. Herb. Oakes Ames).

Comisaría del Putumayo, Umbria, 0° 54' N., 76° 10' W., alt. 325 m., January–February 1931, *G. Klug* 1930, “verde yoco” (U.S. Nat. Herb. No. 1518076); same locality and date, *G. Klug* 1937, “taruco yoco” (U.S. Nat. Herb. No. 1518083); same locality and date, *G. Klug* 1946, “yagé yoco” (U.S. Nat. Herb. No. 1518085); same locality and date, *G. Klug* 1947, “canangucho yoco” (U.S. Nat. Herb. No. 1518086).

ECUADOR: Río San Miguel ó Sucumbíos, entre el Río Putumayo y la Quebrada Teteyé, alt. 260 m., “yoco colorado,” 29 marzo, 1942, *Richard Evans Schultes* 3476 (Econ. Herb. Oakes Ames).

Paullinia Yoco belongs to the section *Enourea* (Aubl.) Radlk. of the genus according to Radlkofer's recent treatment of the Sapindaceae (Pflanzenr. IV, 165 (1931) 232—Sapindaceae I). This section contains eight species, all rather closely allied and all from northern South America (the Guianas, northwestern Brazil, southern Colombia and Peru). *Paullinia Yoco* appears to be most closely related to *P. clathrata* Radlk. of the Amazonas of Brazil, a region floristically very like the Colombian Amazonas and Putumayo where the new species is native. *Paullinia clathrata* (according to descriptions and a photograph of the type) differs from *P. Yoco* in being much larger vegetatively, in having subdentate instead of entire leaves, and in having leaf-pubesence. There are also several floral characters which serve to separate the two species. In Radlkofer's key to the section *Enourea*, the type material of *Paullinia Yoco* traces out to *P. conduplicata* (Klotzsch) Radlk. However, *Paullinia Yoco* is distin-

guished from *P. conduplicata* by its very much smaller size, by the type of its pubescence, and by several floral characters.

II. *The identification of yoco*

Curiously enough, yoco has been given relatively little attention in anthropological and botanical writings. The earliest attempt to identify yoco botanically was apparently that of Dr. Florent Claes of Brussels who made a trip to the Caquetá, Colombia, in 1925 to investigate *yajé* (*Banisteriopsis* spp.) and *yoco*. Dr. Claes made several excursions with Fray Gaspar de Pinell, then a Capuchin missionary in the Putumayo-Caquetá-Amazonas region, and succeeded in collecting a quantity of stems of yoco for chemical analysis and flowering specimens of the plant for taxonomic study. Fray Gaspar, writing in 1929 of Claes' work (Gaspar de Pinell: "Excursión apostólica por los Ríos Putumayo, San Miguel de Sucumbíos, Cuyabeno, Caquetá y Caguan" (1929) 168), said (*translated*):

Dr. Claes was very much interested in trying to classify *yajé* and *yoco* with scientific accuracy; this was the main object of his trip. However, since the flowers of these plants are almost microscopic, he had to content himself merely by collecting several specimens of them to examine under powerful microscopes Relative to *yoco*, he writes me the following: 'The yoco is more than probably a member of or at any rate very near to the family *amfeliidias* [sic].'

The material which Claes took back to Europe for chemical studies was analyzed and the results were published before the accompanying herbarium specimens were identified. In 1926, Michiels and Denis ("Sur la liane yocco, drogue à caféine du genre '*Paullinia*,' " Bull. Acad. Roy. Méd. Belg. sér. 5, 6, vii (1926) 424) referred yoco to the genus *Paullinia*. Later, however, de Wilde-man ("Sur le yocco, plante à caféine originaire de Colombie" Compte Rend. 183 (1926) 1350) published a note on

Claes' specimens, stating that, with the help of the Royal Botanic Gardens at Kew, he had been able to determine yoco as *Paullinia scarlatina* Radlk.

According to Radlkofer's monographic treatment of the *Sapindaceae*, *Paullinia scarlatina* does not occur in South America and, in fact, is known only from the provinces of Izabál and Alta Verapaz in Guatemala. It therefore seems quite probable that Claes' material was wrongly determined. It is unfortunate that this mistaken identification has found its way into chemical literature. So far as I have been able to ascertain, Radlkofer does not cite Claes' collections in his monograph. It is impossible to borrow this material for study, but I feel certain that it will be found to be referable to *Paullinia Yoco*.

In 1931, Señor Guillermo Klug,² a collector from Iquitos, Peru, explored the Colombian Putumayo. He made an extensive study and several very excellent collections of yoco in the Inga Indian town of Umbria. Klug's collections of yoco, two of which are fertile, are all referable to *Paullinia Yoco*.

Dr. José Cuatrecasas, of the Instituto de Ciencias Naturales, Bogotá, carried out extensive botanical work, in the Putumayo in 1940. Among Cuatrecasas' material is a sterile collection of yoco from Puerto Piñuna Negra on the Río Putumayo. This collection is likewise referable to *Paullinia Yoco*.

It is possible that another species of *Paullinia* may be employed as yoco. In the Herbario Nacional Colombiano, there is preserved a sterile specimen from the upper Caquetá region (*E. Perez-Arbelaes sin. num.*) identified as *Paullinia pterophylla* Tr. & Planch. The collector made an annotation that this species represents the source of

² I am greatly indebted to Mr. Ellsworth P. Killip of the Smithsonian Institution for permission to study Klug's specimens and for placing at my disposal Klug's unpublished notes on *yajé* and *yoco*.

the yoco which the Indians of the upper Caquetá utilize medicinally as a febrifugal tonic.

The Indians of the Caquetá and Putumayo apparently distinguish between different "kinds" of yoco, but I am unable to account for the differences. Nearly forty years ago, Rafael Zerda Bayon ("Informe del jefe de la expedición científica del año de 1905 a 1906. Lista de las muestras de productos del Caquetá y que podrán ser artículos de exportación." (1906) Bogotá), writing briefly on yoco in his report on a scientific expedition to the Caquetá in 1905-06, stated that the natives distinguished four "kinds" of yoco and also reported (*translated*):

There is a *yoco blanco* ["white yoco"] and a *yoco colorado* ["red yoco"].

His specimens have long since been lost, and he does not explain the exact nature of the differences between the kinds of yoco.

During my ethnobotanical studies in the Putumayo, I repeatedly questioned natives concerning the differences between *yoco blanco* and *yoco colorado* with conflicting replies. While it is true that the sap expressed from some stems makes a light chocolate-brown mixture when added to cold water, that from other stems makes a whitish milky mixture. Both taste the same, and both are equally effective as a stimulant. The Indians do not prefer one to the other. I find that it is impossible to distinguish botanically the liana which gives *yoco blanco* from that which yields *yoco colorado*, but the natives can distinguish them immediately by slashing the bark with a machete. I have noted that *yoco colorado* nearly always is a much stouter and apparently older plant than *yoco blanco*. It is possible that there is a chemical difference due to age. It seems hardly probable that the differences are due to seasonal or soil conditions, for *yoco blanco* and *yoco colorado* grow side by side and can be collected at the same time.

Klug has collected data of great interest relative to the different "kinds" of yoco. His five collections from Umbria are annotated with different names which would suggest that the Inga Indians of the region regard them as different. Klug's notes unfortunately do not explain the nature of these differences nor why the Indians have these distinct names. A careful examination of Klug's specimens fails to reveal a single botanical character which would suggest that any other species or variety is represented; all of his collections are referable to *Paullinia Yoco*. The several common names annotated by Klug are as follows: *blanco yoco*; *huarmy yoco*; *taruca yoco*; *yagé yoco*; *canangucha yoco*; *verde yoco*. No mention is made of *yoco colorado*. Two of these names suggest that yoco may be used in connection with other plants. The name *yagé yoco* might mean that *Paullinia Yoco* is used together with the narcotic *yajé* (*Banisteriopsis inebrians* Morton and other species). *Canangucha yoco* might suggest that *Paullinia Yoco* is taken with *chicha de cananguche*, an alcoholic drink prepared from the fruits of *Mauritia minor* Burret. All of my data, however, as well as those which others have published, indicate that yoco is always used alone.

III. The chemistry of yoco

A number of sections of stem (totalling some ninety-six pounds) of the type plant (*Schultes 4028*) were collected and have been submitted to Dr. Barriga-Villalba of the Laboratorios Samper-Martínez, Bogotá, for phytochemical examination. The results will be published in an early number of *Caldasia*. This analysis will be interesting because former chemical studies of yoco were undertaken with material the exact identity of which is as yet not known.

In 1926, Rouhier and Perrot ("Le 'yocco,' nouvelle

drogue simple à caféine” Bull. Sci. Pharm. 33 (1926) 537-539—Trav. Lab. Mat. Méd. 17, pt. 6² (1926)—Compt. Rend. 182 (1926) 1494—Chem. Zentralbl. 1 (1927) 138) reported on the chemical constitution of yoco stems received from Dr. Claes and from a French consular official in Quito, Ecuador. At the time of the publication of this report, the plant had not been identified even as to the family. For this reason, Rouhier and Perrot were forced to refer to the plant simply as “le yocco, nouvelle drogue simple à caféine.” As I have indicated above, it is probable that these plant materials, which shortly after the appearance of Rouhier and Perrot’s paper were mistakenly identified as *Paullinia scarlatina*, are referable to *Paullinia Yoco*.

According to Rouhier and Perrot, yoco “bark” (by which is meant probably all tissues outside of the xylem) contains 6.1% ash, 12.3% water, and 2.73% caffeine. Michiels and Denis (Journ. Pharm. Belg. 8 (1926) 795—Chem. Zentralbl. 1 (1927) 138) report that the inflorescences of yoco also contain caffeine.³

Thus, yoco may be added to that list of plant species which are rich in caffeine. Among the more important caffeine-yielding plants are: coffee (*Coffea arabica* L. and other species) of the *Rubiaceae*; tea (*Camellia sinensis* (L.) O. Ktze.) of the *Theaceae*; kola nut (*Cola nitida* (Vent.) A. Chev.) and cacao (*Theobroma Cacao* L.) of the *Sterculiaceae*; maté (*Ilex paraguariensis* St. Hil.) of the *Aquifoliaceae*; and guaraná (*Paullinia Cupana* HBK.) of the *Sapindaceae*.

In all of these species, the highest caffeine concentration is found in the leaves, fruits or seeds. Consequently, these are the economically important parts of the plant.

³ The chemical composition of yoco has been summarized in Wehmer: “Die Pflanzenstoffe,” ed. 2, 2 (1931) 730.

Paullinia Yoco is apparently the first plant in which the bark is utilized for its caffeine content.

IV. Notes on related species of *Paullinia*

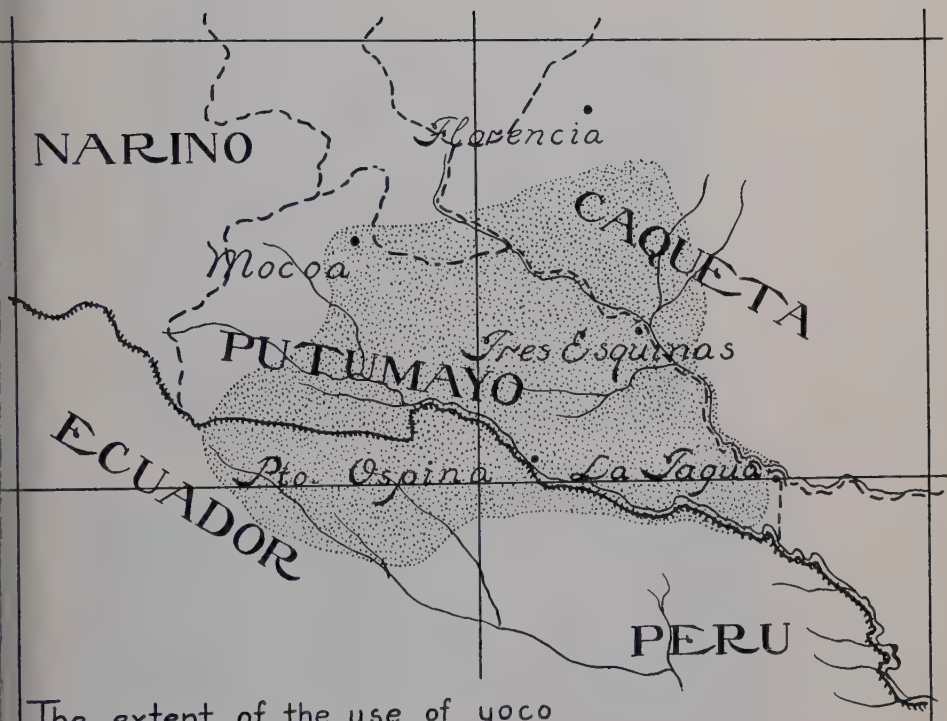
It is of interest to note that *Paullinia* and the very closely related genus *Serjania* contain extremely toxic species, including a number of very active fish-poisons.

Paullinia Cururu L. is an ingredient of a certain type of curare in South America. *Paullinia australis* St. Hil. is a highly toxic Argentinian species containing in its leaves and roots a sedative and narcotic alkaloid. The bark of the roots of *Paullinia pinnata* L. (*timbo*) is a narcotic poison, and in Brazil certain Indians are said to employ it in the preparation of a slow poison.

Guaraná, derived from *Paullinia Cupana* HBK., said to be the most stimulating of all the caffeine beverages, is used in most of the Amazon Valley of Brazil as a coffee substitute. The seeds are pulverized, mixed with cassava flour (*Manihot esculenta* Crantz), and formed into small moulds of various shapes. Upon drying, these moulds become very hard. The beverage, which is made by dissolving this *pasta guaraná* ("guaraná paste") in hot or cold water, is astringent and bitter due to the rather high tannin content (2-3%) of this species. The stimulant properties are due to the high caffeine content which is usually 3-4%, but which may occasionally be as high as 6%. *Paullinia sorbilis* Mart., usually considered to be the same as *P. Cupana*, but which is possibly distinct, is also a source of guaraná.

V. The use of yoco

The area in which yoco is employed as a stimulant is rather restricted, comprising, according to all available reports, the Comisaría del Putumayo and the westernmost part of the Comisaría del Caquetá in Colombia, a



The extent of the use of yoco

EXPLANATION OF THE ILLUSTRATIONS

PLATE XXVIII. *PAULLINIA YOCO Schultes & Killip*. Upper figure, basal portion of a stem of the liana showing the milky sap exuding from the wound. Puerto Porvenir, on the Río Putumayo near the mouth of the Río San Miguel, Comisaría del Putumayo, Colombia, July 1942. (Photograph of the type: *Schultes 4028*.)—Lower figure, pieces of the stem. Santa Rosa, on the upper Río San Miguel, Comisaría del Putumayo, Colombia, April 1942.

PLATE XXIX. *PAULLINIA YOCO Schultes & Killip*. Upper figure, a Kofán Indian preparing yoco: rasping the epidermis, cortex and phloem. Puerto Porvenir, on the Río Putumayo near the mouth of the Río San Miguel, Comisaría del Putumayo, Colombia, July 1942.—Lower figure, a Kofán Indian preparing yoco: expressing the milky sap of the rasped material. Puerto Conejo, on the upper Río San Miguel, Comisaría del Putumayo, Colombia, April 1942.

PLATE XXVIII



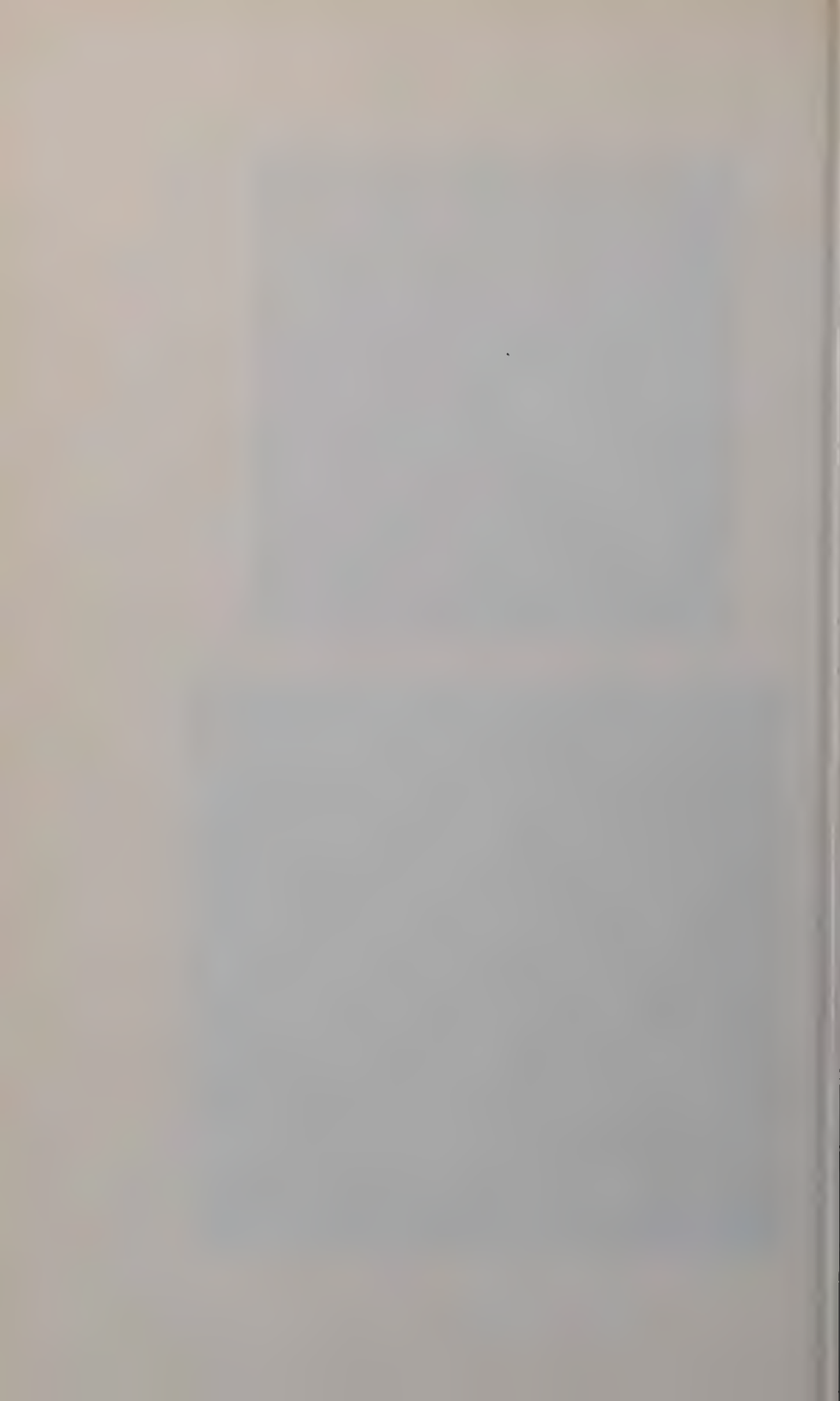
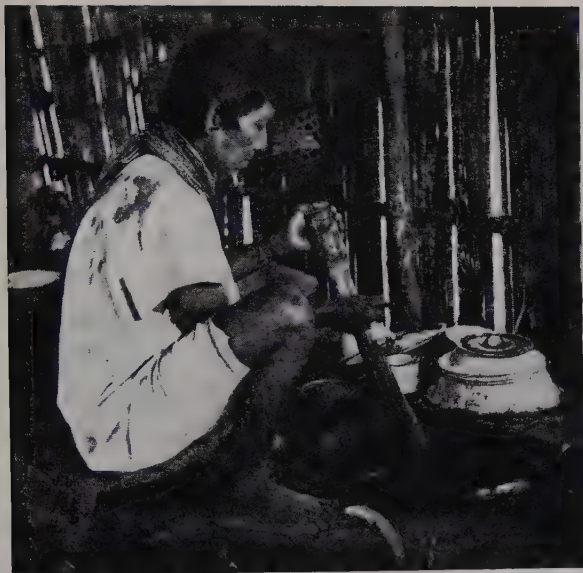


PLATE XXIX



small portion of Peru which borders upon the Colombian Putumayo, and northeastern Ecuador as far south as Agaurico and possibly beyond.

It is strange that the use of yoco is so restricted since *Paullinia Yoco* or very closely allied species apparently have a wider range. The Huitoto and Bora Indians of the Colombian Intendencia del Amazonas do not use yoco, do not know the plant by this name, and are not aware of the purpose for which Indians of the neighboring parts of the Putumayo employ it. Even those Huitotos who have migrated from the Amazonas to the Coreguaje Indian area of the Caquetá and who have adopted many Coreguaje customs, have not taken up the use of yoco. The fact that the Huitoto Indians use coca habitually might seem to explain their lack of interest in yoco. This is not the case, however, for in the town of Nuevo Mundo (near Tres Esquinas), Caquetá, I found the Coreguaje Indians employing both coca and yoco.

So far as I have been able to ascertain, the only tribes which drink yoco are the Ingas of Mocoa, Umbría, Puerto Limón and other localities in the Putumayo; the Sionas of the Putumayo; the Kofáns of San Antonio Guamues, Puerto Conejo, Santa Rosa, and Puerto Ospina in the Putumayo and of Aguarico in Ecuador, and the Coreguajes of the Caquetá. (cf. also Claes: "Chez les Indiens Huitotos et Correguajes" Bull. Soc. Roy. Belg. Geogr., fasc. 2 (1931) 101—Gaspar de Pinell, loc. cit., 161.) All of these Indians use the name *yoco* which is apparently of Inga origin. In the language of the Kofán, Siona and Coreguaje Indians there is no name for *Paullinia Yoco*.

Although it is a stimulant and not a food, *Paullinia Yoco* is one of the most important plants in the diet of the Indians of the Putumayo and western Caquetá. Every Indian household keeps a large supply of yoco stems,

and few Indians ever make a long trip through the forest or by canoe without carrying two or three pieces. Yoco is cut from wild lianas chiefly. I have never seen *Paullinia Yoco* cultivated, but Padre Javier de Quito, a missionary who has spent nearly forty years in the Putumayo, informs me that occasionally a plant may be found under cultivation in an Indian clearing. In 1906, Bayon reported that the Indians of the Caquetá "cultivate it with care."

Because of the great demand for yoco, wild plants of *Paullinia Yoco* are becoming hard to find wherever there are Indian settlements. It is believed that scarcity of yoco is one of the causes of the occasional abandonment of excellent town-sites by an entire village of Indians, although epidemics account for most of these town-migrations. The Kofáns of Puerto Ospina informed me that there is not a sufficient supply of yoco nearer than twenty kilometers and that the only remedy will be to move the village nearer to the wild supply. At the present time, an Indian from the vicinity of Puerto Ospina must make a long day's trip in order to reach a region where plants of yoco are growing and, after arriving, must search to find a liana suitable for felling.

Lianas of *Paullinia Yoco* which have a stout stem at least three inches in diameter at the base are utilized (plate xxviii, upper figure). Usually several trees must be felled before the liana falls to the ground. Starting at the root, the stem is then cut into pieces which may vary from one to three feet in length. These pieces are stored in cool corners of Indian houses (plate xxviii, lower figure) and retain their stimulating properties for a month or even longer.

In the preparation of the beverage from the yoco stems, the epidermis, cortex and phloem (all of the softer tissues external to the xylem) are rasped (plate xxix, upper fig-

ure). The scraps of material thus obtained are squeezed to express the caffeine-bearing sap into cold water. If the yoco is rather old and dry, the rasped material is allowed to soak (plate xxix, lower figure) and the stimulating principles are quickly removed. After extraction, the remains of the rasped tissues are discarded. When prepared, *yoco blanco* is a cloudy milky-white liquid, but in the case of *yoco colorado* the liquid is light chocolate-brown in color. Both kinds are used without discrimination; apparently one is as strong a stimulant as the other. Yoco is never made with hot water. In this respect it differs markedly from *Paullinia Cupana* and other caffeine-yielding plants, for the extraction of caffeine from these plants is usually accomplished with warm or hot water.

Each dosage of yoco consists of the expressed sap of approximately 90–100 grams of rasped material served in a “jícara,” a bowl made from the fruit of *Crescentia Cujete* L.

It is the general custom of the Indians of the Putumayo to eat nothing until noontime. Instead, yoco is taken each morning between five and six o'clock. One or two “jícaras,” each half full of the beverage, are sufficient to allay all sensations of hunger for at least three hours and to supply muscular stimulation. I have tried yoco on many occasions and find that the statements of the natives regarding the stimulating and hunger-allaying properties are not in the least exaggerated. The effects of the stimulant are rapid in action. A tingling of the fingers and a general feeling of well-being are noticeable ten minutes after drinking the contents of two “jícaras.” I have made long trips through the forests, and, taking nothing but yoco, have felt neither fatigue nor hunger. Klug (unpublished notes: “Plants of Umbría, between the Rivers Alto Putumayo and Alto Caquetá, 360 meters above sea level,” preserved in the United

States National Herbarium and in the Library of Economic Botany, Botanical Museum of Harvard University) has written:

"I, myself, as well as three students who accompanied me on my exploration to the upper Rio Putumayo, have taken yoco on different occasions, and we were able to state that this happened in every detail: in a whole day of walking (20-25 kilometers) not only have we felt no hunger, but we have felt no fatigue In the regions mentioned one never finds an Indian making a long trip by land or by canoe without taking along a branch of this vine, which is his food and keeps him from feeling the fatigues of his journey."

In 1906, Zerda Bayon (loc. cit.) wrote (*translated*):

They take it to acquire strength, vigor and agility for their long canoe-paddlings, for hunting trips, and for their tiring trips through the jungles; and in order not to feel hunger. Their breakfast is infallibly a draught of yoco

In addition to its use as a stimulant, yoco is employed, in larger dosages, as an anti-malarial febrifuge and as a medicine in the treatment of a bilious disease which is frequent in the Putumayo. I found these uses prevalent among the Inga, Siona, Kofán and Coreguaje Indians. The same uses have been reported by several investigators who have been in other parts of the Putumayo and Caquetá. Klug (loc. cit.), for example, reports:

. . . this liana has the property, perhaps chiefly antibilious, of curing the malarial fevers in this region

It is with pleasure that I express herewith my appreciation of the assistance given me during my ethnobotanical investigations in the Putumayo by the Colombian Ministerio de Guerra and the Capuchin Mission of the Putumayo and Caquetá. Special thanks are tendered to Colonel Gomez-Pereyra, commander of the base at Caucayá; to Captain Rojas-Scarpeta, commander of the gunboat "Cartagena," and to the Reverend Padres Gaspar de Pinell and Marcelino de Castellví.

INDEX

TO GENERA AND SPECIES

ACHRAS

- mammosa* L., 148
- Sapota* L., 142
- Zapota* auct., non L., 142, 148
- Zapota* L., 142

ACHROANTHES

- floridana* Greene, 55

AECHMEA

- magdalenae* (André) André ex Baker, 142

AFRAMOMUM

- Melegueta* (Rosc.) K. Schum., 142

AGAVE

- cubensis* Jacq., 157
- hexapetala* Jacq., 157

ALISMA

- Plantago-aquatica* auct. Am., non L., 143
- subcordata* Raf., 143

ALLIUM

- cepa* L., 242
- fistulosum* L., 242

ALOE

- barbadensis* Mill., 143
- perfoliata* L.
- [var.] *π. vera* L., 143
- vera* "L." auct. plur., non Mill., 143
- vulgaris* Lam., 143

AMOMIS

- acris* Berg, 165

- caryophyllata* Krug & Urb., 165

AMOMUM

- Melegueta* Rosc., 143

AMYGDALUS

- communis* L., 143, 166

ANANAS

- magdalenae* Standl., 142, 143

ANDIRA

- Araroba Aguiar*, 143

ANEMONE

- groenlandica* Oeder, 152

ANHALONIUM

- Williamsii* Lem., 160

ANIBA

- Coto* (Rusby) Kosterm., 144

ANONA

- uncinata* Lam., 145

APIUM

- crispum* Mill., 163
- latifolium* Mill., 163
- Petroselinum* L., 163

ARALIA

- Ginseng* Baill., 163

ARISAEMA

- atrorubens* (Ait.) Bl., 144
- pusillum* (Peck) Nash, 144
- triphyllum* auct. plur., non Schott, 144
- triphyllum* (L.) Schott, 144

ARMORACIA

- lapathifolia* Gilib., 144

- rusticana* Gaertn., Meyer & Scherb., 144
- ARTABOTRYS**
odoratissimus R. Br., 145
uncinatus (Lam.) Merr., 145
- ARTOCARPUS**
altilis (Park.) Fosberg, 145
champedon Spreng., 146
communis Forst., 145
heterophyllus Lam., 145
incisus L.f., 145
integra sensu Merr., 146
integra (Thunb.) Merr., 145, 146
integrifolius auct., non L. f., 145
- ARUM**
atrorubens Ait., 144
triphyllum atropurpurea Michx., 144
- ASAGRAEA**
officinalis (Schlecht. & Cham.) Lindl., 146, 168
- ASPASIA**
lunata Lindl., 23
pusilla C. Schweinf., 21
- AULIZEUM**
pygmaeum "Ldl." ex Stein, 56
- AVICENNIA**
marina (Forsk.) Vierh., 146
nitida Jacq., 146
nitida Thunb., 146
- BANISTERIOPSIS**
spp., 309
inebrians Morton, 312
- BARBOSELLA**
cucullata Schltr., 139
rhynchantha Schltr., 139
- BARRINGTONIA**
asiatica (L.) Kurz, 146
speciosa J. R. & G. Forst., 146, 147
- BASSIA**, 160
latifolia Roxb., 147, 160
- BERRYA**
Ammonilla Roxb., 172
cordifolia (Willd.) Burr., 172
- BETULA**
alba L., 147
pendula Roth, 147
verrucosa Ehrh., 147
blanco-yoco, 312
- BLETIA**
domingensis Reichb.f., 50
Lindenii Reichb.f., 46
Ortgesiana Reichb.f., 48
- BOLDEA**, 163, 164
Boldus Looser, 163, 164
- BOLDU**, 164
Boldus (Mol.) Lyons, 147, 163
- BOMBAX**, 167
Ceiba L., *pro parte*, 167
Gossypium L., 151
heptaphyllum Houtt., 167
malabarica DC., 147, 167, 168
religiosa L., 151
- BOTHRIOCHILUS**, 86
densiflorus (Rolfe) Ames & Correll, 86
- BRACHYTELE**
Lechleri Schltr., 29
- BRASSICA**
alba (L.) Rabenh., 147
arvensis (L.) Rabenh., 147
hirta Moench, 147
Kaber (DC.) Wheeler, 147
- BRAUNERIA**, 148

BROMELIA

magdalenae C. H. Wright, 142

BROUGHTONIA, 41, 42, 43,
44, 48

alba Spreng., 45

amoena Wall. ex Lindl., 45

aurea Lindl., 45

candida Otto, 45

chinensis Lindl., 41, 45

coccinea Hook., 44

cubensis Cogn., 49

domingensis Rolfe, 47, 50

fusca Wall. ex Hook., 45

grandiflora Spreng., 45

lilacina Henfrey, 47, 50

linearis Wall. ex Lindl., 45

maculata Spreng., 45

nitida Herb. ex Sweet, 45

pendula Wall. ex Lindl., 45

pilosa Hook. ex Steud., 46

sanguinea (Sw.) R. Br., 44,
45, 48, 50

tetragona Spreng., 46

violacea Hort. ex Moore &
Ayres, 50

BURSERA

Aloëxylon (Schiede ex
Schlecht.) Engl., 147, 148
Delpechiana Poiss. ex Engl.,
147, 148

glabrifolia (HBK.) Engl., 147
penicillata (Sessé & Moc. ex

DC.) Engl., 148

cacao, 313

Calaqual, 2

CALOCARPUM

mammosum (L.) Pierre, 148,
149

Sapota (Jacq.) Merr., 148

CAMARIDIUM

grandiflorum Schltr., 13

CAMELLIA

sinensis (L.) O. Ktze., 149,
313

Thea Link, 149

CAMPYLOCENTRUM

Brenesii Schltr., 90

longicalcaratum A. & S., 90

microphyllum Ames & Correll,
88

cananguche yoco, 312

CANTHIUM

dicoccum (Gaertn.) Merr., 149

didymum Gaertn.f., 149

CARALLIA

brachiata (Lour.) Merr., 149

integerrima A. P. DC., 149

CARYOPHYLLUS

aromaticus L., 149, 156

racemosus Mill., 164

CASEARIA

praecox Griseb., 149, 158

CASSIA

acutifolia Delile, 150

fistula L., 150

Senna L., 150

CATHARTOCARPUS

Fistula Pers., 150

CATTLEYA

41, 42
aurantiaca (Batem.) P. N. Don,
45

domingensis Lindl., 41, 42, 43,
50

CATTLEYOPSIS

42, 43, 46, 49
delicatula Lem., 42, 43, 46

guanensis Acuña, 46, 58

Lindenii (Lindl.) Cogn., 43,
46, 49, 50, 58

Northropiorum Cogn., 46, 47

Ortgesiana (Reichb.f.) Cogn.,
 44, 46, 48
rosea Mansf., 48
CHEVALLIERA
Magdalenae André, 142
chicha de cananguche, 312
CHLOIDIA
flava Griseb., 55
CHRYSANTHEMUM
coccineum Willd., 150
roseum Adam, 150
CITRUS
Aurantium L.,
 var. *sinensis* L., 150
Limon (L.) Burmf., 150
Limonia auct., non Osbeck,
 150
Limonium Risso, 150
Medica L.
 β. *Limon* L., 150
 var. *Limon* L., 150
sinensis (L.) Burmf., 150
coca, 321
COCHLEARIA
Armoracia L., 144
rusticana Lam., 144
COCHLOSPERMUM
Gossypium DC., 151
religiosum (L.) Alston, 151
COELIA
densiflora Rolfe, 86
COELOGLOSSUM
viride (L.) Hartm., 263
COELOGYNE
 sp.?, 45
fimbriata Lindl., 45
 ?*triptera* Brongn., 56
COFFEA
arabica L., 313

coffee, 313
COLA
acuminata auct., non Schott &
 Endl., 151
acuminata (Beauv.) Schott. &
 Endl., 151
nitida (Vent.) A. Chev., 151,
 313
vera K. Schum., 151
COLPOON, 156
CONVOLVULUS
purga Wend., 157
COPAIBA, 151, 152
conjugata O. Ktze., 152
copallifera O. Ktze., 152
COPAIFERA, 151, 152
conjugata (Bolle) Milne-
 Redhead, 152
copallifera (Benn.) Milne-
 Redhead, 152
copallina Baill., 152
Gorskiana Benth., 152
Guibourtiana Benth., 152
COPAIVA, 152
COPTIS, 153
groenlandica (Oeder) Fern.,
 152
trifolia auct., non Salisb., 153
trifolia (L.) Salisb., 152, 153
CORYMBORCHIS
cubensis Acuña ex Correll, 55
flava Hemsl. sensu Cogn., 55
COUMAROUNA, 153, 154
CRANICHIS
hieroglyphica Ames & Correll,
 61
Wagneri Reichb.f., 62, 63
CRESCENTIA
Cujete L., 323

Cresta de Gallo, 2

CRYPTOCARYA, 164

CYBISTAX

Donnell-Smithii (Rose) Seib.,
153

CYCLOPOGON

Rimbachii Schltr., 30

CYDONIA

oblonga Mill., 153
vulgaris Pers., 153

CYMBIDIUM

lineare Sw., 5

CYPRIPEDIUM

bulbosum Mill., 153
Calceolus L., pro parte, 153
Calceolus L.
var. *pubescens* (Willd.)
Correll, 153
parviflorum Salisb., 153, 154
var. *pubescens* (Willd.)
Knight, 154
pubescens Willd., 154

DENDROBIUM

sanguineum Sw., 41, 44

DIATOMA

brachiata Lour., 149

DICHAEA

graminoides (Sw.) Lindl., 13
squarrosa Lindl., 39
trichocarpa Lindl., 39

DIENIA

calycina Lindl., 32

DIPTERYX, 154

ECHINACEA, 148, 154

ECHINOCACTUS

Williamsii Lem., 154, 160

ECHINOCYSTIS

fabacea Naud., 154

ELAPHRIUM

Aloërylon Schiede ex

Schlecht., 148

Delphechianum Rose, 148

glabrifolium HBK., 148

penicillatum Sessé & Moc., 148

ELLEANTHUS

lancifolius Presl, 13

linifolius Presl, 13

ENTADA

phaseoloides (L.) Merr., 154
scandens Benth., 154, 155

EPIDENDRUM, 41

alticola Ames & Correll, 80
arbuscula Lindl., 82
bifidum Aubl., 51
bisulcatum Ames, 82
caespitosum Poepp. & Endl., 56
centropetalum Reichb.f., 82
chinense (Lindl.) Ames, 41,
45, 51
comayaguense Ames, 82
cubense Lindl., 41, 49
fusiforme (Lindl.) Reichb.f., 12
Karwinskii Reichb.f., 12
lineare Jacq., 1, 5, 6
monanthum Steud., 56
myrianthum Lindl., 82
[var.] *album* "Rehb.f." ex
Will., 82
pygmaeum Hook., 56
ramosum Jacq., 13
var. *lanceolatum* Griseb., 57
roseum Schltr., 48
rubrum Lam., 170
sanguineum Sw., 41, 44
stenopetalum Hook., 12
strobiliferum Reichb.f., 13
teretifolium Sw., 13
tripterum Lindl., 56
tripterum Sm., 56

- uniflorum* Lindl., 56
verrucosum Sw., 82
 var. *myrianthum* (Lindl.)
 Ames & Correll, 82
- ERVUM**
Lens L., 159
- ERYTHRODES**
ovatilabia *Ames & Correll*, 70
secunda *Ames*, 71
- ERYTHROXYLON**, 155
- ERYTHROXYLUM**, 155
- EUCALYPTUS**
camaldulensis *Dehnh.*, 155
longirostris F.v.Muell., 155
rostrata *Schlecht.*, 155
- EUCARYA**, 156
spicata (R. Br.) *Sprague & Summerh.*, 155
- EUCHLAENA**, 217
- EUGENIA**, 156
aromatica (L.) *Baill.*, 156
aromatica *Berg*, 156
caryophyllata *Thunb.*, 156,
- EXOgonium**
Jalapa (Nutt. ex *Coxe*) *Baill.*,
 156, 157
purga (*Wend.*) *Benth.*, 156
- FAGOPYRUM**
esculentum *Moench*, 157
sagittatum *Gilib.*, 157
- FERONIA**
elephantum *Corr.*, 157, 159
Limonia (L.) *Swingle*, 157,
 159
- FLACOURTIA**
cataphracta *Roxb. ex Willd.*,
 157
jangomas (*Lour.*) *Raesch.*,
 157
- FRAGARIA**
Tormentilla *Crantz*, 166
- FURCRAEA**
cubensis (*Jacq.*) *Vent.*, 157,
 158
hexapetala (*Jacq.*) *Urb.*, 157
- FURCROYA**, 157
- FUSANUS**, 155, 156
spicatus R. Br., 155, 158
- GOODYERA**
dolabripetala (*Ames*) *Schltr.*,
 70
major *Ames & Correll*, 68
modesta *Schltr.*, 70
- GORSKIA**
conjugata *Bolle*, 152
- GOSSAMPINUS**, 167
heptaphylla (*Houtt.*) *Bakh.*,
 158, 167
malabarica *Merr.*, 167
- GOSSYPIOSPERMUM**
praecox (*Griseb.*) *P. Wils.*,
 158
- GRINDELIA**
cuneifolia *auct. Am.*, 158
humilis *Hook. & Arn.*, 158
guaraná, 313, 314
guaraná paste, 314
- GUIBOURTIA**
copallifera *Benn.*, 152
- HABENARIA**, 257, 264
alata *Hook.*, 52, 53
Brittonae *Ames*, 52
calva *Rolfe*, 275, 278
cardiophila *Kränzl.*, 260
cavatibrachia *Summerh.*, 273
chlorotica *Reichb.f.*, 259
cirrhatta (*Lindl.*) *Reichb.f.*, 280
coeloglossoides *Summerh.*, 261

combusta Ridl., 260, 261
ctenophora Schltr., 269
decurvirostris Summerh., 275, 278
deflexa Hochst. ex Kränzl., 259
Edgari Summerh., 278
Eggelingii Summerh., 257
entomantha (Llave & Lex.) Lindl.
 var. *subauriculata* (Robins. & Greenm.) Ames & Will. 60
epipactidea Reichb.f., 263
Erythraeae Rolfe, 259
filicornis (Thonn.) Lindl., 259, 260
foliolosa Kränzl., 269
gabonensis Reichb.f., 263
 var. *psiloceras* (Welw. ex Reichb.f.) Summerh., 263
hymenophylla Schltr., 269
keniensis Summerh., 270, 272
laurentii De Wildem., 280
lithophila Schltr., 276, 278
longirostris Summerh., 265, 267
macrantha Hochst. ex A. Rich., 272
Mannii Hook.f., 270
Mechowii Reichb.f., 278, 280
natalensis Reichb.f., 260
nivea (Nutt.) Spreng., 54
njamnjamica Kränzl., 269
Nuttallii Small, 53
obovata Summerh., 261, 263
palustris Acuña, 53
peristylodes A. Rich., 260
praestans Rendle, 269, 270, 272, 273
psiloceras Welw. ex Reichb.f., 263

pubipetala Summerh., 264, 265, 266
Rendlei Rolfe, 260, 261
repens Nutt., 52, 53
replicata A. Rich., 54
rhombocorys Schltr., 265
silvatica Schltr., 267
Spiranthes Reichb.f., 259
splendens Rendle, 273
stenorhynchus Schltr., 269
subauriculata Robins. & Greenm., 60
supplicans Summerh., 267
tenuifolia Summerh., 269
tenuispica Rendle, 257, 259
trachypetala Kränzl., 264, 265, 266, 267
 sect. **Trachypetalae** Summerh. 264
trieruris A. Rich., 273, 274
umbratilis Ames & Will., 59
unifoliata Summerh., 276, 278

HARTWEGIA

purpurea Lindl.
 var. *angustisepala* Booth ex Lindl., 80

Helleborine tenuifolia repens Plum., 5

HELLEBORUS

trifolius L., 152

HEXADESMIA, 27, 85

Acostaei Schltr., 27
bifida Reichb.f., 27
brachyphylla Reichb.f., 28
 var. *longior* Schltr., 28
confusa Schltr., 85
crurigera Lindl., 85
falcata C. Schweinf., 28
Jimenezii Schltr., 28
micrantha Lindl., 85

Powellii Schltr., 27
stenotepala Reichb.f., 28
HEXALECTRIS, 18
brevicaulis L. Wms., 18, 20
mexicana Greenm., 18, 20
parviflora L. Wms., 18, 20
revoluta Correll, 18, 19, 20
spicata (Walt.) Barnh., 18, 20
HEXOPIA
crurigera Batem. ex Lindl., 85
HORMIDIUM
Hiorami Acuña, 52, 57
pseudo-pygmaeum Finet, 56
pygmaeum Benth. & Hook.f.
ex Hemsl., 56
tripterum Cogn., 56
uniflorum Heynh., 56
huarmy yoco, 312
HUMBOLDTIA
caulescens O.Ktze., 139
purpurea Ruiz & Pav., 37
ILEX
paraguariensis St. Hil., 313
ILLIPE
latifolia (Roxb.) F.v.Muell.,
158, 160
IPOMOEA
Jalapa Nutt. & Cox, 157
purga Hayne, 157
IRIS
caroliniana S.Wats., 158
virginica L., 158
ISOCHILOS, 2
graminifolium Spreng., 13
ramosum (Jacq.) Spreng., 13
ISOCHILUS, 1, 2
alatus Schltr., 11
Amparoanus Schltr., 11
brasiliensis Schltr., 5, 6
carnosiflorus Lindl., 7

cernuum Lindl., 12
chiriquensis Schltr., 9, 10
crassiflorus A.Rich. & Gal., 7, 8
dubius A.Rich. & Gal., 12
elegans Focke, 12
fusiforme Lindl., 12
globosum (Jacq.) Lindl., 12
graminifolius HBK., 12
graminoides (Sw.) Hook., 13
grandiflorum Lindl., 13
lancifolium (Presl) Lindl., 13
Langlassei Schltr., 5
latibracteatus A.Rich. & Gal.,
9, 10
leucanthus Rodr., 5
linearis (Jacq.) R.Br., 1, 4, 5, 9
var. *carnosiflorus* (Lindl.)
Correll, 4, 5, 7
var. *β. leucanthus* Cogn., 5
var. *unilateralis* (Robins.)
Correll, 4, 5, 8, 9, 11
linifolium (Presl) Lindl., 13
lividum Lindl., 13
major Cham. & Schlecht., 1, 4,
9, 11
var. *alatus* (Schltr.) Correll,
4, 8, 11
var. *Amparoanus* (Schltr.)
Correll, 4, 10, 11
pauciflorus Cogn., 5, 6
peruvianus Schltr., 5, 6
prolifer R.Br., 13
proliferum (R.Br.) Lindl., 13
ramosus Focke, 13
teretifolium (Sw.) Lindl., 13
unilateralis Robins., 9
JACQUINIELLA
globosa (Jacq.) Schltr., 12
JAMBOSA
Caryophyllus Nidenz., 156
kola nut, 313

LAELIA, 41, 42, 46*domingensis* Millsp., 51*Lindenii* Lindl., 41, 42, 43, 46**LAELIOPSIS**, 41, 42, 43, 48, 49*chinensis* (Lindl.) "Lindl."

ex Reichb.f., 51

cubensis (Lindl.) "Lindl." ex*Cogn.*, 49*domingensis* Lindl., 42, 43,

49, 50

Lindenii (Lindl.) "Lindl." ex*Cogn.*, 46**LAVANDULA***officinalis* Chair, 158*Spica* L., 158, 159*vera* DC., 158**LENS***culinaris* Medik., 159*esculenta* Moench, 159*phaseoloides* L., 154**LEONTODON***Taraxacum* L., 159, 169*vulgaris* Lam., 169**LEPANTHES***alticola* C. Schweinf., 121*caudatisepala* C. Schweinf., 123*costata* Reichb.f., 123*decipiens* A. & S., 126*duidensis* A. & S., 126*eciliata* Schltr., 125*excedens* Ames & Correll, 72*pumila* C. Schweinf., 125*rupicola* Schltr., 123*Schnitteri* Schltr., 126*sillarensis* Schltr., 126*Wendlandii* Reichb.f., 125**LEPTANDRA***virginica* Nutt., 171**LEPTOTHRIUM**, 2*lineare* Kunth ex Steud., 5**LIMON***vulgaris* Mill., 150**LIMONIA**, 159*acidissima* L., 159**LIMONIUM**, 159**LIPARIS***elegantula* Kränzl., 33*Galeottiana* Hemsl., 79*Millei* Schltr., 33*ramosa* Poepp. & Endl., 34*Rusbyi* Rolfe, 34*vexillifera* (La Llave & Lex.)*Cogn.*, 79var. *Galeottiana* (A. Rich.

& Gal.) Ames & Correll,

79

LOPHOPHORA*Williamsii* (Lem.) Coult., 160**LUCUMA***mammosa* Gaertn.f., 148, 160**MADHUCA**, 160*indica* Gmel., 160*latifolia* (Roxb.) Macbr., 160*longifolia* Macbr., 160**MAJORANA***hortensis* Moench, 160**MALAXIS***Brittonii* Acuña, 55*calycina* O. Ktze., 32*carnosa* (HBK.) C. Schweinf.,

32

Galeottiana A. Rich. & Gal., 79*gracilis* O. Ktze., 32*floridana* O. Ktze., 55*monticola* Ames, 32*spicata* Sw., 55*termensis* (Kränzl.)*C. Schweinf.*, 33**MALVA***neglecta* Wallr., 160*pusilla* Sm., 161

- rotundifolia* auct., non L.,
160, 161
- MAMMEA**
asiatica L., 146
- MANIHOT**
esculenta Crantz, 172, 314
utilissima Pohl, 172
- MANILKARA**
bidentata (A. DC.) Chev., 172
Kauki (L.) Dubard, 161
- MARAH**
fabacea Greene, 154
- MASDEVALLIA**
Arminii Reichb.f., 115
auropurpurea Reichb.f. &
Warscz., 34
brachyura Lehm. & Kränzl., 34
Herzogii Schltr., 34
pandurilabia C. Schweinf., 113
triangularis Reichb.f., 115
zanthura Schltr., 34
- maté*, 313
- MAURITIA**
minor Burret, 312
- MAXILLARIA**
alba Lindl., 45
graminifolia (HBK.) Reichb.f.
12
grandiflora Lindl., 45
Haenkei Correll, 13
maculata Lindl., 45
- MEGARRHIZA**
californica Torr., 154, 161
- MICRAMPELIS**
fabacea (Naud.) Greene, 154,
161
- MICROSTYLIS**
calycina Ridl., 32, 33
floridana Chapm., 55
- gracilis* Ridl., 32
humilis Cogn., 57
microtoides Schltr., 32
monticola Schltr., 32
spicata Lindl., 55
termensis Kränzl., 33
- MIMOSA**
scandens L., 154
- MIMUSOPS**
Balata (Aubl.) Pierre, 172
globosa auct., 172
Kauki L., 161
- MORMODES**, 16
histrio Linden & Reichb.f., 14,
15, 16
lineatum Batem. ex Lindl., 14,
15
lineatum Lindl., 16
- MUCUNA**
pruriens auct., non DC., 161
prurimum Wight, 161
- MYRICA**
carolinensis auct., non Mill.,
172
pennsylvanica Lois.-Desl., 172
- MYROBROMA**
fragrans Salisb., 170
- MYROXYLON**, 162
Balsamum (L.) Harms, 172
Pereirae Klotzsch, 162
- MYRTUS**
acris Sw., 164
caryophyllata Jacq., 164
Caryophyllus Spreng., 156
- NAGELIELLA**
angustifolia (Booth ex Lindl.)
Ames & Correll, 80
purpurea (Lindl.) L. Wms., 80
- NASTURTIIUM**
Armoracia Fries, 144

NAUCLEA, 162

esculenta (*Afzel.*) *Merr.*, 162

Gambir *Hunt.*, 170

NECTANDRA

Coto *Rusby*, 144, 162

NEONAUCLEA, 162

NEOTTIA

quadridentata *Willd.*, 68

vaginata *HBK.*, 31

Nido de Pajaro, 2

OCTOMERIA

boliviensis *Rolfe*

var. *grandiflora* *C.Schweinf.*,
194

brachypetala *Schltr.*, 196

complanata *C.Schweinf.*, 195

tenuis *Schltr.*, 196

OPHRYS

monophyllos *Pav. ex Lindl.*, 32

ORCHIS

repens *Raf.*, 53

ORIGANUM

Majorana *L.*, 160, 162

OTOCHILUS

sp.?, 46

alba *Lindl.*, 45

fusca *Lindl.*, 45

OTOPETALUM

tunguraguae *Lehm. & Kränzl.*,
180

OUROUPARIA, 170

Gambir (*Hunt.*) *Baill.*, 163,
170

PACHYSTELE

confusa *Schltr.*, 85

PANAX

Ginseng (*C.A.Mey.*) *Baill.*,
163

Schinseng *Nees*, 163

PARATECOMA

Peroba (*Record*) *Kuhlman*, 163

pasta guaraná, 314

PAULLINIA, 314

australis *St. Hil.*, 314

clathrata *Radlk.*, 308

conduplicata (*Klotzsch*)

Radlk., 308, 309

Cupana *HBK.*, 313, 314, 323

Cururu *L.*, 314

pinnata *L.*, 314

pterophylla *Tr. & Planch.*, 310

scarlatina *Radlk.*, 310, 313

sorbilis *Mart.*, 314

Yoco *Schultes & Killip*, 302,
310, 312, 313, 314, 321, 322

PELEXIA

corymbosa *Lindl.*, 31

hondurensis *Ames*, 66

laxa *Lindl.*, 29

maculata *Rolfe*, 30

olivacea *Rolfe*, 66

subaequalis *Ames*, 66

PETROSELINUM

crispum (*Mill.*) *Nym.*, 163

hortense *Hoffm.*, 163

sativum *Hoffm.*, 163

PEUMUS, 164

Boldus *Mol.*, 163, 164

PHAIUS

tetragonus *Reichb.f.*, 46

PIMENTA

acris (*Sw.*) *Kostel.*, 164

racemosa (*Mill.*) *J.W. Moore*,
164

PINUS

longifolia *Roxb.*, 172

montana *Mill.*, 165

Mughus *Scop.*, 165

Mugo *Turra*, 165

Roxburghii *Sarg.*, 172

PIPER

officinatum (Miq.) C.DC., 165
retrofractum *Vahl*, 165

PLANTAGO

arenaria Waldst. & Kit., 165
indica *L.*, 165
ramosa *Aschers.*, 165

PLATANThERA

repens *Wood*, 53

PLECTRONIA

dicocca *Merr.*, 149
didyma *Elmer*, 149

PLEUROTHALLIS, 27

angustisegmenta *C. Schweinf.*,
139
angustisepala *Ames & Correll*,
74
asperilinguis *Reichb.f.*, 178
barbulata *Lindl.*, 176
bivalvis *Lindl.*, 189
Blaisdellii *S. Wats.*, 79
brevispicata *C. Schweinf.*, 173
Cassidis *Lindl.*, 194
caudatipetala *C. Schweinf.*, 175
caulescens *Lindl.*, 139
chamaelepanthes *Reichb.f.*,
182
chamensis *Lindl.*, 176
var. *tenuis* *C. Schweinf.*, 176
crucilabia *Ames & Correll*, 76,
174
cucullata *Ames*, 139
dilatata *C. Schweinf.*, 177
echinocarpa *C. Schweinf.*, 179
expansa *Lindl.*, 194
fuegii *Reichb.f.*, 189
gigantea *Lindl.*, 180
gnomonifera *Ames*, 79

graminea *Schltr.*, 140
Hitchcockii *Ames*, 187
inaequisepala *C. Schweinf.*,
180

intricata *Lindl.*, 192
lanceolata *Lindl.*, 182
var. *gracilis* *C. Schweinf.*, 182
lepanthoides *Schltr.*, 174
longiserpens *C. Schweinf.*, 183
macrorhiza *Lindl.*, 184
microcharis *Schltr.*, 182
muricata *Schltr.*, 180
Otopetalum *Schltr.*, 180
quadrata *C. Schweinf.*, 184
rhynchantha *L. Wms.*, 139
ringens *C. Schweinf.*, 186
Rowleei *Ames*, 75
soratana *Reichb.f.*, 184
spathulifolia *C. Schweinf.*, 188
subsinuata *Lindl.*, 189
Talpinaria *Reichb.f.*, 189
tenuis *C. Schweinf.*, 190
triangulipetala *Ames & Correll*
77
trilineata *Lindl.*, 178
trilobata *Fawc. & Rendle*, 77
trimeroglossa *Reichb.f.*, 189,
190
truncicola *Reichb.f.*, 189
Vargasii *C. Schweinf.*, 192

POLYSTACHYA, 257

aconitiflora *Summerh.*, 295
alpina *Lindl.*, 283
angustifolia *Summerh.*, 293
appendiculata *Kränzl.*, 289
ashantensis *Kränzl.*, 292
bicarinata *Rendle*, 290
Buchanani *Rolfe*, 280
caespitifica *Kränzl.*, 295, 297,
298
composita *Kränzl.*, 288

cultriformis (Thou.) Spreng., 289
dendrobiiflora Reichb.f., 298
Doggettii Rendle & Rolfe, 283, 290, 291, 292
eusepala Kränzl., 290
fusiformis (Thou.) Lindl., 288
galeata (Sw.) Reichb.f., 283, 290, 292
Gillettii De Wildem., 290
Goetzeana Kränzl., 283
golungensis Reichb.f., 282
gracilenta Kränzl., 289
grandiflora Lindl., 283, 284
Holstii Kränzl., 283
 sect. **Humiles** Summerh., 284
hypocrita Reichb.f., 280
inconspicua Rendle, 283, 292
ionocharis Kränzl., 283
isochiloides Summerh., 288
kermesina Kränzl., 283
kilimanjari Kränzl., 283
Kindtiana De Wildem., 282
latilabris Summerh., 297
Lawrenceana Kränzl., 283
lepidantha Kränzl., 280, 281
Lettowiana Kränzl., 280
longiscapa Summerh., 298
Lujue De Wildem., 289
melanantha Schltr., 283
Mildbraedii Kränzl., 293
minutiflora Ridl., 288
modesta Reichb.f., 282
Ottomaniana Reichb.f., 284
parva Summerh., 285
praecipitis Summerh., 286
purpureo-alba Kränzl., 289
reflexa Lindl., 283
rigidula Reichb.f., 282
rufinula Reichb.f., 281, 282
Schinziana Kränzl., 292

shirensis Reichb.f., 282
similis Bolus, non Reichb.f., 280
similis Reichb.f., 281, 282
subdiphylla Summerh., 294
tenella Summerh., 293
tenuissima Kränzl., 293
tessellata Lindl., 280, 282, 283
tricuris Reichb.f., 280
virginea Summerh., 290
vulcanica Kränzl., 297
zanguebarica Rolfe, 281

POPULUS

balsamifera L., 165
Tacamahacca Mill., 165

POTENTILLA

erecta (L.) Raeusch., 165
Tormentilla (Crantz) Neck., 166

PREMNA

arborea (Forst.f.) Farwell, 166
taitensis Schau., 166

PRUNUS

Amygdalus Batsch, 166
communis Arcang., 166

PSYDRAX

dicoccus Gaertn., 149

PSYLLIUM

ramosum Gilib., 165

PYRETHRUM

roseum Bieb., 150

PYRUS

Cydonia L., 153

RADEMACHIA

incisa Thunb., 145
integra Thunb., 146

RADICULA

Armoracia Robins., 144

RESTREPIA

cucullata Lindl., 139
rhynchantha Reichb.f., 139
RIBES
Grossularia L., 166
Uva-crispa L., 166
ROEPEROCHARIS, 261, 263
ukingensis Schltr., 260
RORIPA, 144
RORIPPA, 145
Armoracia (L.) Hitchc., 144,
 166
ROUREA
glabra HBK., 166
oblongifolia Hook. & Arn., 167
RUIZIA, 164
fragrans Ruiz & Pav., 163
SABADILLA, 168
officinalis (Schlecht. & Cham.)
 Standl., 167, 168
officinarum Brandt, 168
SALMALIA, 167
malabarica (DC.) Schott &
 Endl., 167
Sanguinaria, 2
SANTALUM
spicatum, A.DC., 155
SAPOTA
Achras Mill., 142, 168
mammosa Mill., 148
Sapota fructu ovato majori Plum.,
 142
SARCOCEPHALUS
esculenta Afzel. ex R.Br., 162,
 168
SASSAFRAS
albidum (Nutt.) Nees, 172
variifolium (Salisb.) O. Ktze.,
 172
Satyrium parasiticum... P.Br., 44

SCAPHYGLOTTIS, 27, 85
Acostaei (Schltr.) C.Schweinf.,
 27
Behrii (Reichb.f.) Benth. &
Hook.f. ex Hemsl., 84
bifida (Reichb.f.) C.Schweinf.,
 27
brachyphylla (Reichb.f.) C.
Schweinf., 28
confusa (Schltr.) Ames &
Correll, 85
crurigera (Batem. ex Lindl.)
Ames & Correll, 85
falcata C.Schweinf., 28
Jimenezii Schltr., 28, 85
livida (Lindl.) Schltr., 12, 13, 85
mierantha (Lindl.) Ames &
Correll, 85
minutiflora Ames & Correll, 83
Powellii Schltr., 27
prolifera (R.Br.) Cogn., 13
spatulata C.Schweinf., 28
stenotepala (Reichb.f.) C.
Schweinf., 28
SCEURA
marina Forsk., 146
SCHINUS
Limonia L., 159
SCHOENOCaulon, 168
officinalis (Schlecht. & Cham.)
A.Gray, 168
SCROPHULARIA
arborea Forst.f., 166
SERAPIAS
parasitica Pav. ex Ridl., 32
Serapias foliis linearibus Jacq., 5
SERENOA
repens (Bartr.) Small, 172
serrulata (Michx.) Hook.f.,
 172

SERJANIA, 314

SESAMUM

indicum L., 172

orientale L., 172

SIDEROXYLUM

Sapota Jacq., 148

SINAPIS

alba L., 147

arvensis L., 147

Kaber DC., 147

SITODIUM

altile Park., 145

SMILAX

aristolochiaefolia Mill., 168

grandifolia Regel, 169

medica Schlecht. & Cham., 168

Milleri Steud., 168

ornata Hook., 168

ornata Lem., 168, 169

Regelii Killip & Morton, 169

utilis Hemsl., 169

SPATHIGER

Roigii Acuña, 57

SPIRANTHES

assurgens Reichb.f., 67

corymbosa Kränzl., 31

Funciana A. Rich. & Gal.,

66, 67

var. *olivacea* (Rolfe) Ames

& Correll, 66

hyemalis A. Rich. & Gal., 65

laxa (Poepp. & Endl.) C.

Schweinf., 29

Lechleri C. Schweinf., 29

Llaveana Lindl., 67

var. *violacea* (A. Rich. &

Gal.) Ames & Correll, 67

maculata C. Schweinf., 30

picta (Anders.) Lindl., 68

var. *assurgens* (Reichb.f.)

Ames & Correll, 67

prasophylla Reichb.f.

var. *cleistogama* Ames &

Correll, 65

Rimbachii (Schltr.) C.

Schweinf., 30

stolonifera Ames & Correll, 63

subumbellata C. Schweinf., 31

tortilis (Sw.) L. C. Rich., 68

vaginata "Lindl." ex Jacks.,

31

vernalis Engelm. & Gray, 68

violacea A. Rich. & Gal., 67

STANHOPEA

Lewisae Ames & Correll, 86

STELIS

apiculata Schltr., 36

carnosa HBK., 32, 33

concaviflora C. Schweinf., 115

cordibractea Schltr., 37, 38

diffusa C. Schweinf., 117

Endresii Reichb.f., 35, 38, 118

floribunda HBK., 36

glandulosa Ames, 35

graminea Lindl., 121

grandibractea C. Schweinf.,

118

Huancabambae Kränzl., 37, 38

Huebneri Schltr., 35

insignis Ames, 36

lamellata Lindl., 121

Lindleyana Cogn.

var. *carnosior* C. Schweinf.,

120

loxensis Lindl., 119

minuta C. Schweinf., 120

parvibractea Ames, 35

phaeantha Schltr., 37, 38

pleurothalloides Ames, 116

praesecta Schltr., 35

propinqua Ames, 35

purpurea (Ruiz & Pav.)

Willd., 37

rhomboglossa *Schltr.*, 116
 thecoglossa *Reichb.f.*, 119
 truncata *Lindl.*, 37
 violascens *Schltr.*, 35
STENORRHYNCHUS
 laxus *Poepp. & Endl.*, 29
 vaginatus *Spreng.*, 31
STERCULIA
 nitida *Vent.*, 151
STIGMAROTA
 jangomas *Lour.*, 157
STIZOLOBIUM
 pruriens *auct.*, non *Medik.*,
 161, 169
 pruriturum (*Wight*) *Piper*, 161,
 162
SYNASSA
 corymbosa *Lindl.*, 31
SYZYGIUM, 156
 aromaticum *Merr. & Perry*, 156
TABEBUIA
 Donnell-Smithii *Rose*, 153, 169
TALPINARIA
 bivalvis *Karst.*, 189, 190
TARAXACUM
 Dens-leonis *Desf.*, 169
 officinale *Weber ex Wigg.*,
 169
 vulgare *Schrank*, 169
Taruca yoco, 312
tea, 313
TECOMA
 Peroba *Record*, 163, 169
teocentli, 245
teosinte, 217, 222, 230
THEA
 sinensis *L.*, 149, 169
THEOBROMA
 Cacao *L.*, 313

timbo, 314
TIPUANA
 Lundellii *Standl.*, 169, 171
TOLUIFERA, 162
 Balsamum *L.*, 172
 Pereirae *Baill.*, 162, 169
TORMENTILLA
 erecta *L.*, 165
TRIPSACUM, 217, 218, 219,
 222, 223, 230, 231, 232, 234,
 239, 240, 244, 245
 laxum *Scribn. & Merr.*, 232
 pilosum *Scribn. & Merr.*, 232
TRITICUM
 aestivum *L.*, 170
 sativum *Lam.*, 170
 vulgare *Vill.*, 170
TYLOPHORA
 asthmatica (*L.*) *Wight & Arn.*,
 172
 indica (*Burm.f.*) *Merr.*, 172
UNCARIA, 170
 Gambir (*Hunt.*) *Roxb.*, 170
USTILAGO
 Zeae (*Beckm.*) *Ung.*, 233
UVARIA
 odoratissima *Roxb.*, 145
VANILLA
 fragrans (*Salisb.*) *Ames*, 170
 planifolia *Andrews*, 170
VATAIREA
 Lundellii (*Standl.*) *Killip*, 171
VATAIREOPSIS, 143
 Araroba (*Aguiar*) *Ducke*, 143,
 171
VERATRUM, 168
 officinale *Schlecht. & Cham.*,
 168
verde yoco, 312

VERONICA

virginica L., 171

VERONICASTRUM

virginicum (L.) Farwell, 171

VIBURNUM

americanum auct., non Mill.,
171

Opulus L.

var. *americanum* Ait., 171

trilobum Marshall, 171

Viscum radice bulbosa minus . . .
Sloane, 44

VOUACAPOUA, 143

Araroba (Aguiar) Lyons, 143,
171

yagé yoco, 312

yajé, 309, 312

yoco, 301, 309, 310, 311, 312,
313, 314, 321, 322, 323

yoco blanco, 311, 323

yoco colorado, 311, 312, 323

ZEA, 217

ERRATA

- page 5, line 28
for 48 read 58
- page 36, lines 7 and 8
for *C. Schweinfurth* read *C. Schweinfurth*
- page 43, line 31
for in equal pairs read in unequal pairs
- page 45, line 14
for *caudida* read *candida*
- page 55, line 7
for *Corymborchis* read *Corymbis*
- page 57, line 2
for fig. 4 read fig. 3
- page 57, line 18
for 614 read 618
- page 64, line 4
delete cum
- page 82
delete lines 20 and 21
- page 149, line 27
for *aromatica* read *aromaticus*
- page 155, lines 25 and 31
for Summerhays read Summerhayes
- page 155, line 31
for (1917) read (1927)
- page 156, line 14
for *aromatica* read *aromaticus*
- page 165, line 15
for Waldt. read Waldst.
- page 166, line 20
for Archangeli read Arcangeli
- page 246, line 7
for resevoir read reservoir
- page 274, line 11
for papillato-puberuli read papillato-puberulae
- page 280, line 4
for *Mechrowii* read *Mechowii*
- page 283, line 12
for this read his
- page 301, line 26 (footnote)
for *Caldasia* 1 read *Caldasia* No. 4